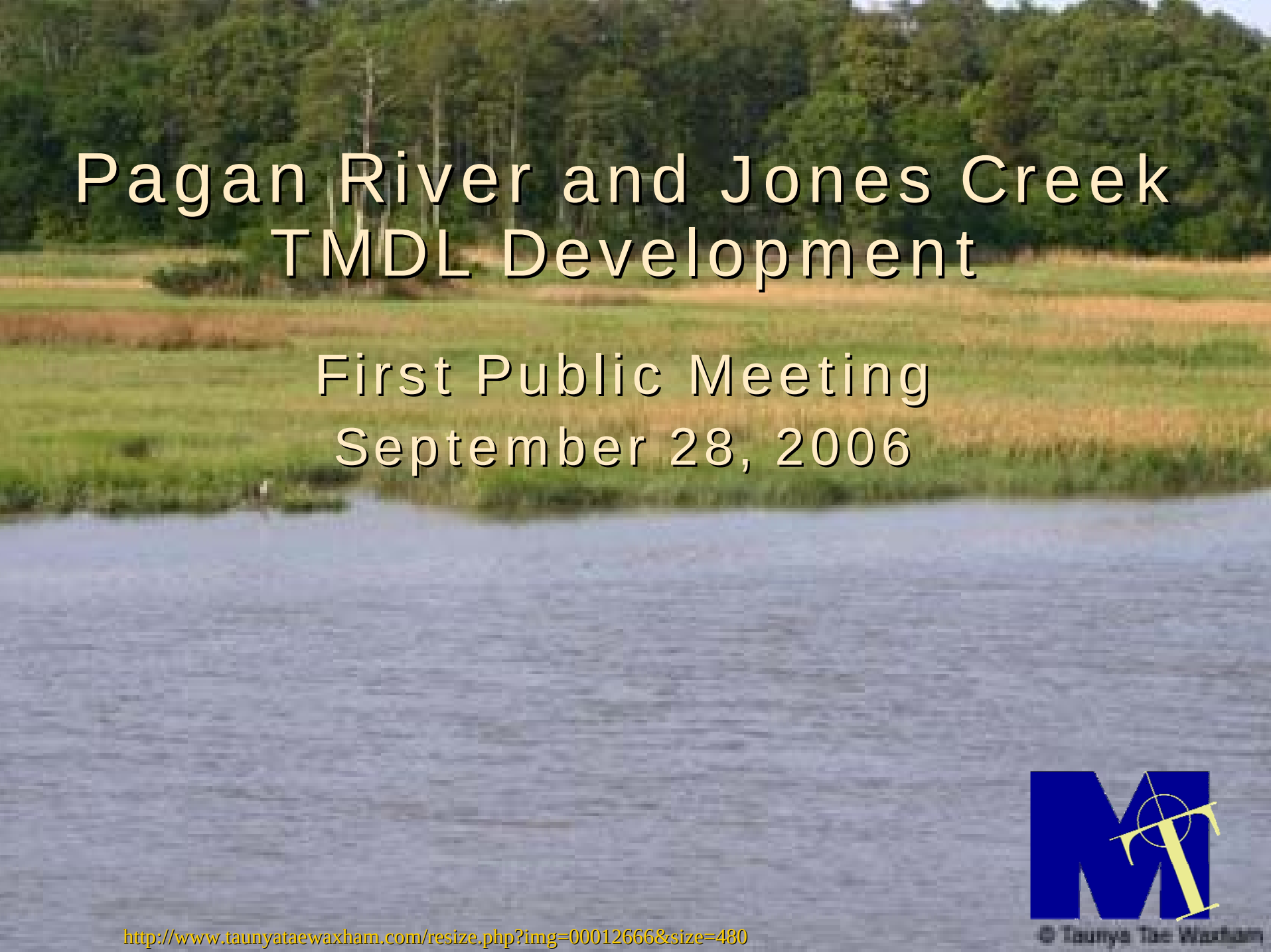
Pagan River and Jones Creek TMDL Development

First Public Meeting
September 28, 2006



Why Are We Here?

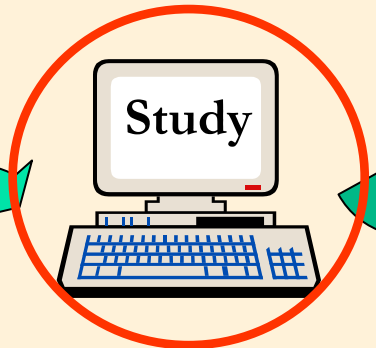
- Clean Water Act 1972
  - States must develop a list of impaired waters
  - States must develop TMDL studies for waters listed
- Consent Decree 1999
  - States, including VA, were sued by the American Canoe Association
  - By 2010, VA must complete TMDL studies for all waters listed in 1998

Why Are We Here?

- To discuss TMDLs for the Pagan River and Jones Creek
  - Total Maximum Daily Load
  - It is how much pollutant can enter the stream and have the stream meet the water quality standards

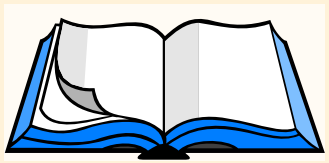
TMDL Process Flow Chart

The State begins a formal process to clean up that water body (a TMDL)



- Identifies sources of pollution
- Calculates amounts from each source
- Estimates necessary pollutant reductions

Implementation Plan



- Identifies permit controls or best management practices needed to make necessary pollutant reductions

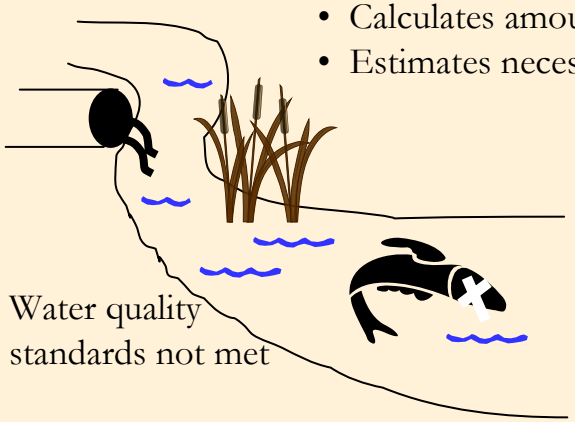
Implementation

Monitoring

Clean

Water quality standards met

Polluted



Water quality standards not met

The Process

Created by Robert Brent, DEQ

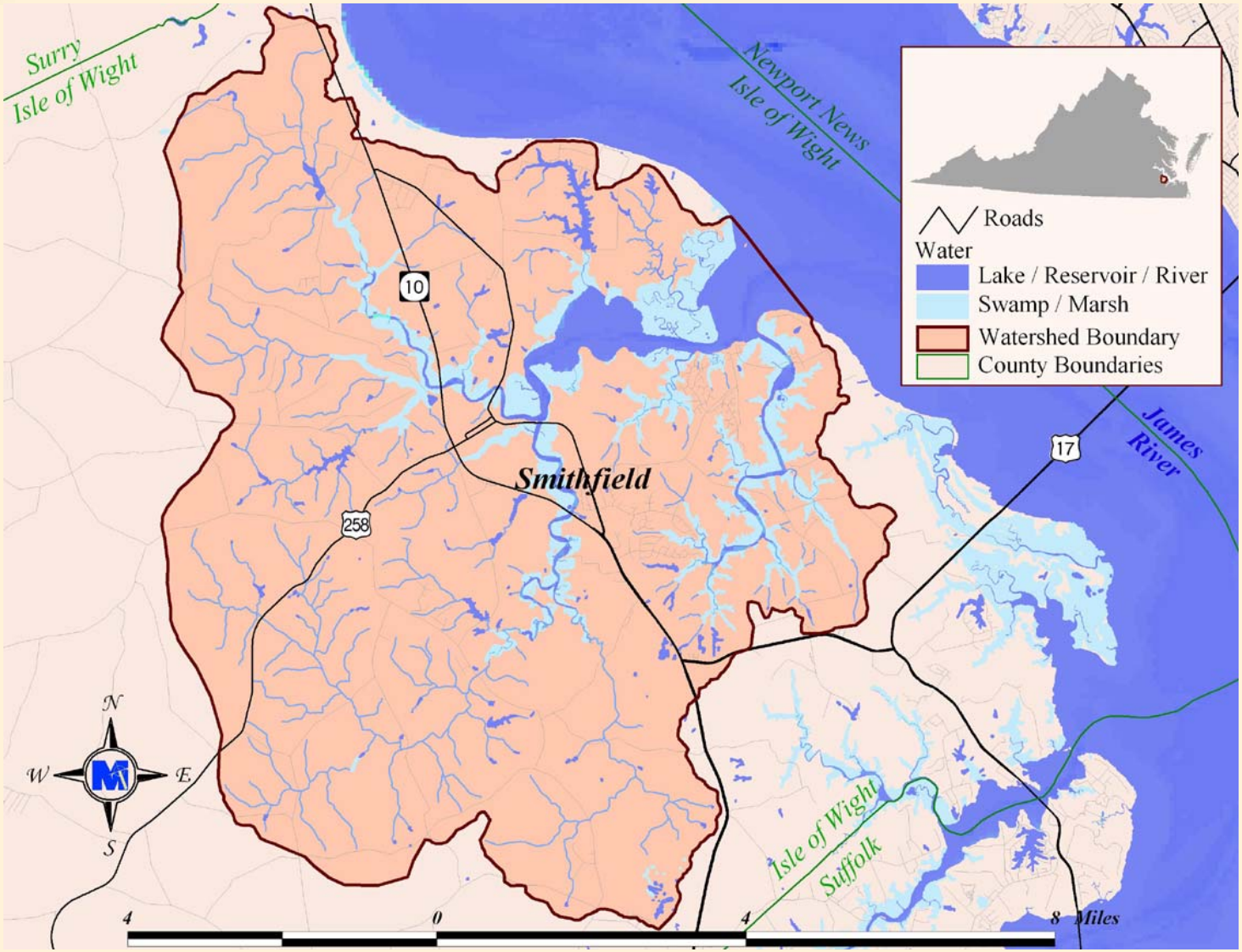
TMDL Development Steps

- Monitoring/Listing - Identify Water Quality Problem
  - Monitoring Ongoing
  - ✓ Listing Completed by DEQ and VDH
- Source Assessment – Locate Potential Sources of Pollutant in Watershed
  - → Estimates Presented here – Please validate
- Modeling – Examine the Movement of Pollutant from Land to Water and Direct Inputs to Water
- Allocation/TMDL – Use a Computer Model to Determine the Load Reductions Necessary to Achieve Water Quality Goals

Water Quality Standards = Goals

- **DEQ Primary Contact Recreational Use**
  - *Enterococci* Bacteria (for Estuarine)
    - Two standards
      - 35 cfu/100mL geometric mean
      - 104 cfu/100mL instantaneous sample
- **VDH Shellfish Harvesting Use**
  - Fecal Coliform
    - Two standards
      - 30-month 14 MPN geometric mean
      - 30-month 90th percentile 49 MPN

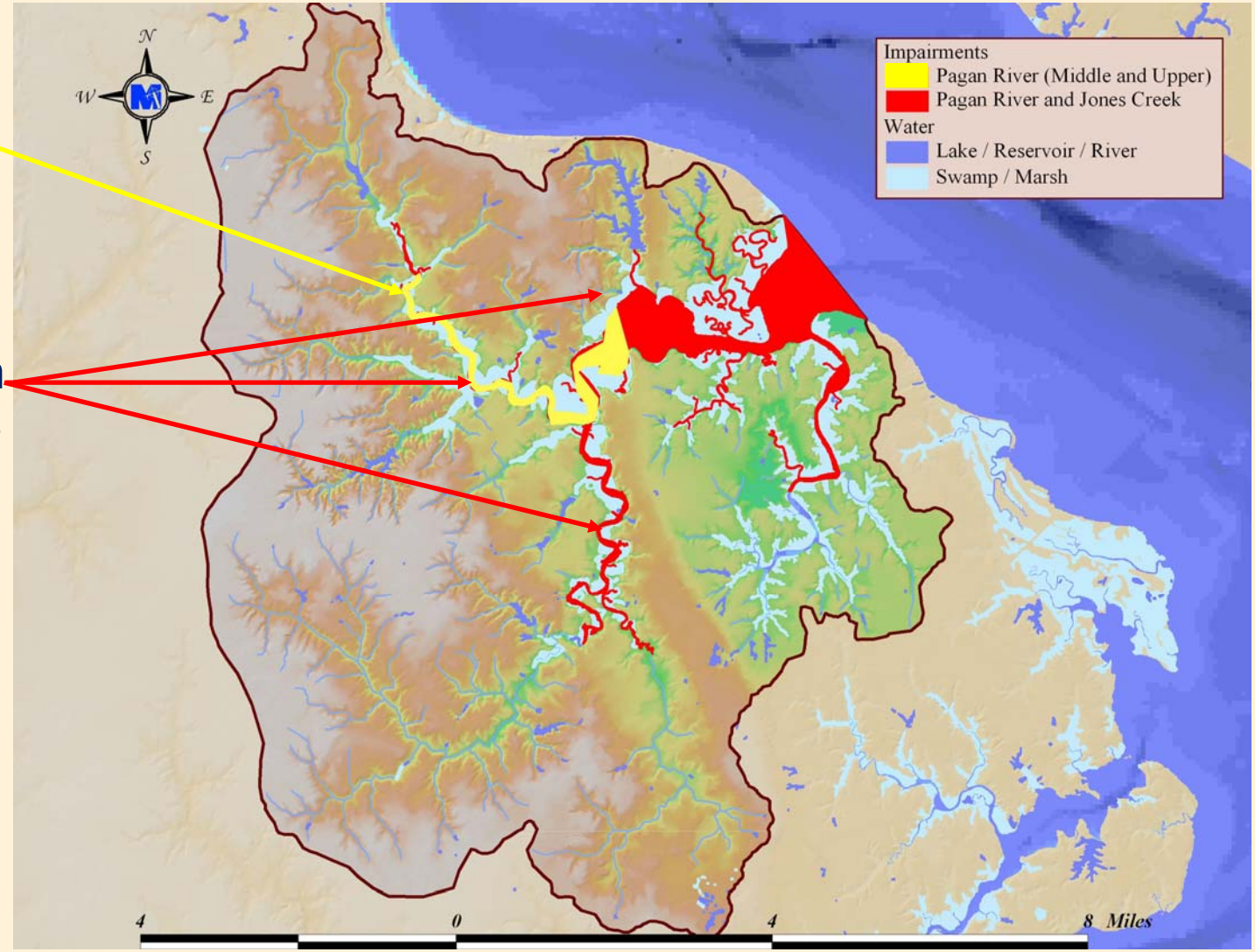
Where is the Watershed?



Where are the Impairments?

DEQ –
Swimming Use

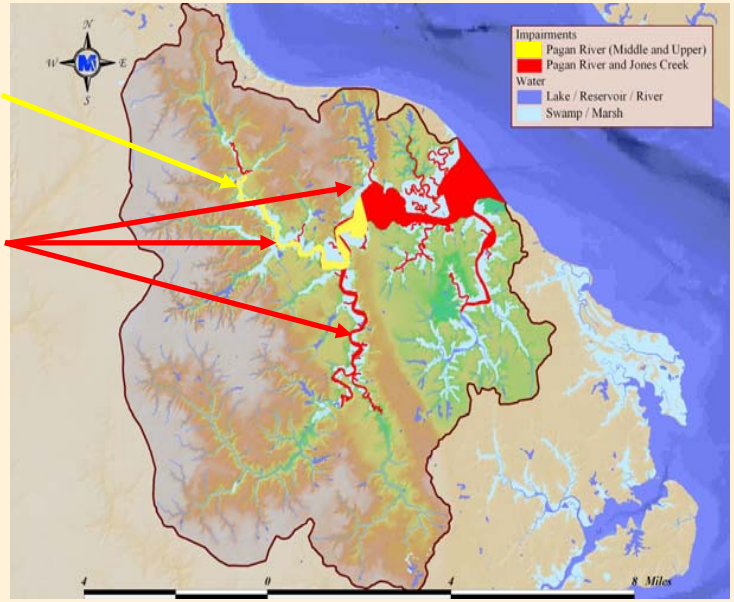
VDH – Shellfish
Harvesting Use



Where are the Impairments?

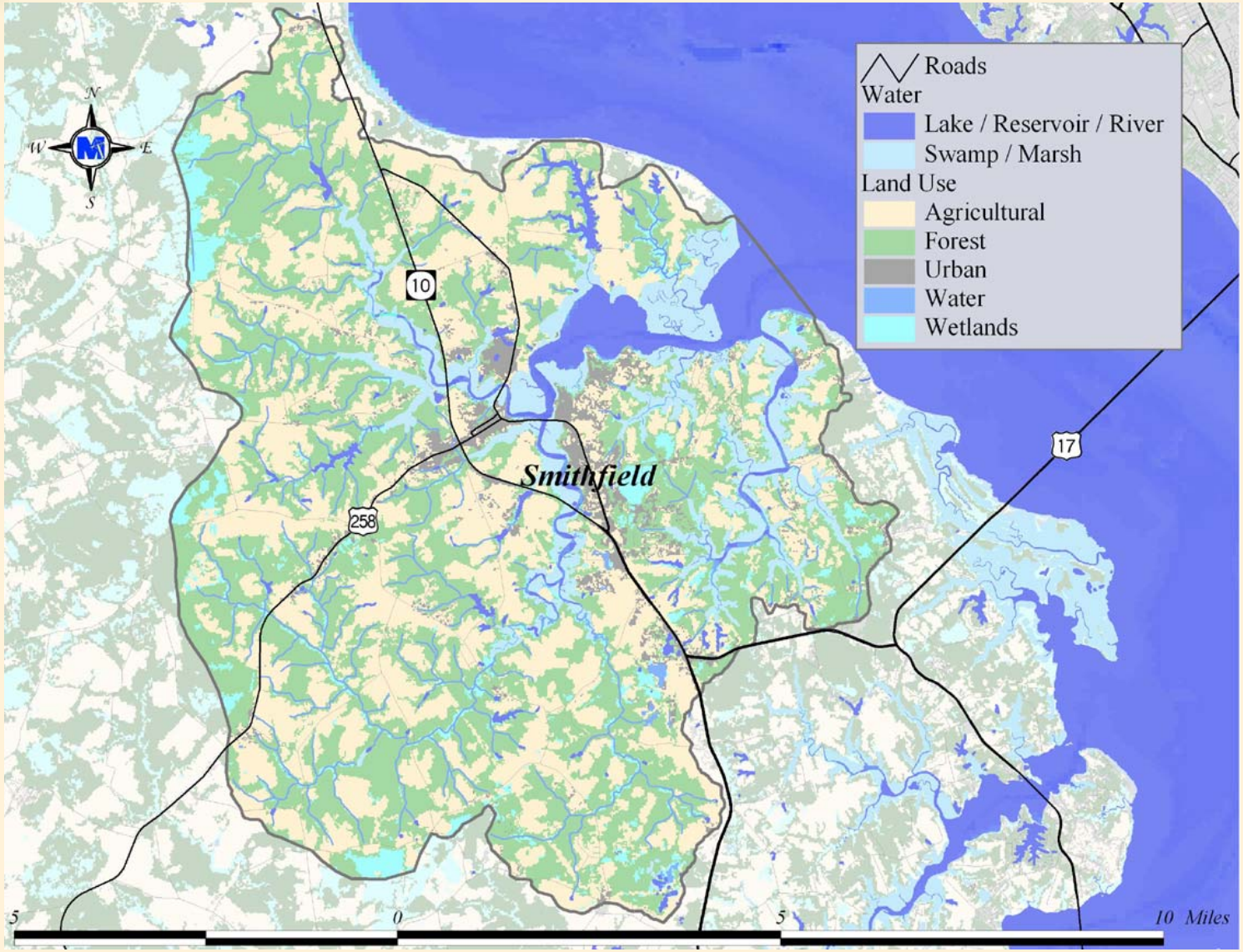
DEQ

VDH



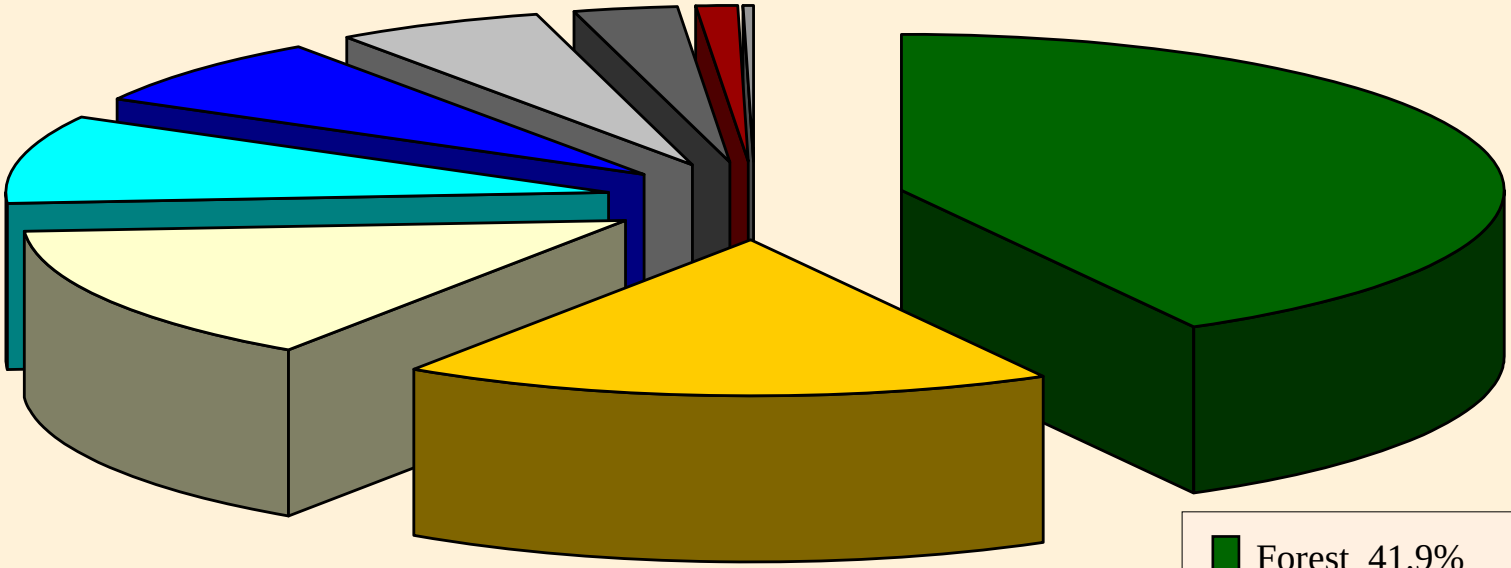
Impairment Name	Listed by	Reason Listed	Extent Description	Extent River Miles	Color in Figure
Pagan River (Middle and Upper)	DEQ	Excess fecal bacteria for swimming	End of tidal influence to downstream of Smithfield at Red Point	9.25 to 4.00	Yellow
Pagan River and Jones Creek	VDH	Excess fecal bacteria for harvesting shellfish	VDH-DSS Condemnation Area #061-064	9.5 to 0.0	Red

Land Use


Roads
Water
Lake / Reservoir / River
Swamp / Marsh
Land Use
Agricultural
Forest
Urban
Water
Wetlands
N
W
E
S
10
17
258
Smithfield
5
0
5
10 Miles

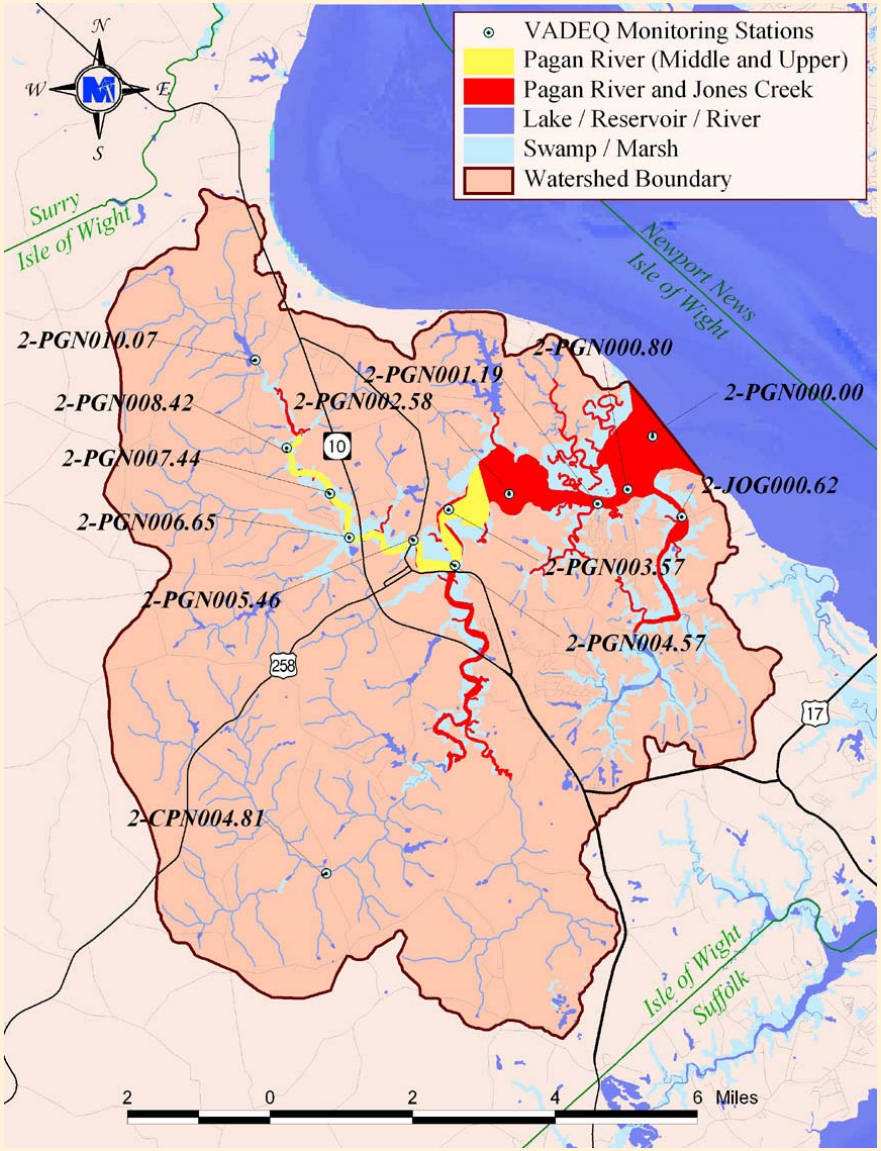
Land Use Percentage

Total watershed area is about 46,420 acres



- Forest 41.9%
- Row Crops 17.4%
- Pasture/Hay 14.4%
- Wetland 9.2%
- Water 7.3%
- Low Intensity Residential 5.6%
- Commercial 2.6%
- Barren 1.1%
- High Intensity Residential 0.4%

VADEQ Monitoring



VADEQ Fecal Coliform Data

January 1980 through November 2005

Stream	Station	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Standard Deviation	# above 400 cfu/100mL	Violation[1] (%)
Champion Swamp	2-CPN004.81	9	50	500	185	159	1	11%
Jones Creek	2-JOG000.62	126	2	2,400	98	273	6	5%
Pagan River	2-PGN000.00	117	2	1,600	46	156	2	2%
Pagan River	2-PGN000.80	127	2	2,400	104	300	4	3%
Pagan River	2-PGN001.19	129	2	7,000	142	651	8	6%
Pagan River	2-PGN002.58	126	2	1,600	149	300	10	8%
Pagan River	2-PGN003.57	123	2	24,000	520	2,203	26	21%
Pagan River	2-PGN004.57	123	2	11,000	531	1,168	34	28%
Pagan River	2-PGN005.46	138	5	71,600	1,516	6,731	53	38%
Pagan River	2-PGN006.65	124	2	24,000	812	2,369	49	40%
Pagan River	2-PGN007.44	122	4	24,000	893	3,052	48	39%
Pagan River	2-PGN008.42	125	2	24,000	1,160	3,682	50	40%
Pagan River	2-PGN010.07	264	2	9,200	405	837	55	21%

[1]Violations are based on the current fecal coliform instantaneous standard (400 cfu/100mL)

VADEQ E. coli Data

July 2002 through October 2004

Station	Stream	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Standard Deviation	# above 235 cfu/100mL	Violation[1] (%)
Champion Swamp	2-CPN004.81	3	50	210	113	85	0	0%
Jones Creek	2-JOG000.62	10	10	100	30	31	0	0%
Pagan River	2-PGN000.00	10	10	20	12	4	0	0%
Pagan River	2-PGN000.80	10	10	80	23	23	0	0%
Pagan River	2-PGN001.19	10	10	30	15	8	0	0%
Pagan River	2-PGN002.58	10	10	30	15	8	0	0%
Pagan River	2-PGN003.57	10	10	70	33	23	0	0%
Pagan River	2-PGN004.57	10	10	90	44	30	0	0%
Pagan River	2-PGN005.46	10	10	80	35	24	0	0%
Pagan River	2-PGN006.65	10	20	280	85	78	1	10%
Pagan River	2-PGN007.44	10	10	140	73	39	0	0%
Pagan River	2-PGN008.42	10	10	250	78	66	1	10%
Pagan River	2-PGN010.07	20	10	2,000	210	452	2	10%

[1]Violations are based on the current E. coli instantaneous standard (235 cfu/100mL)

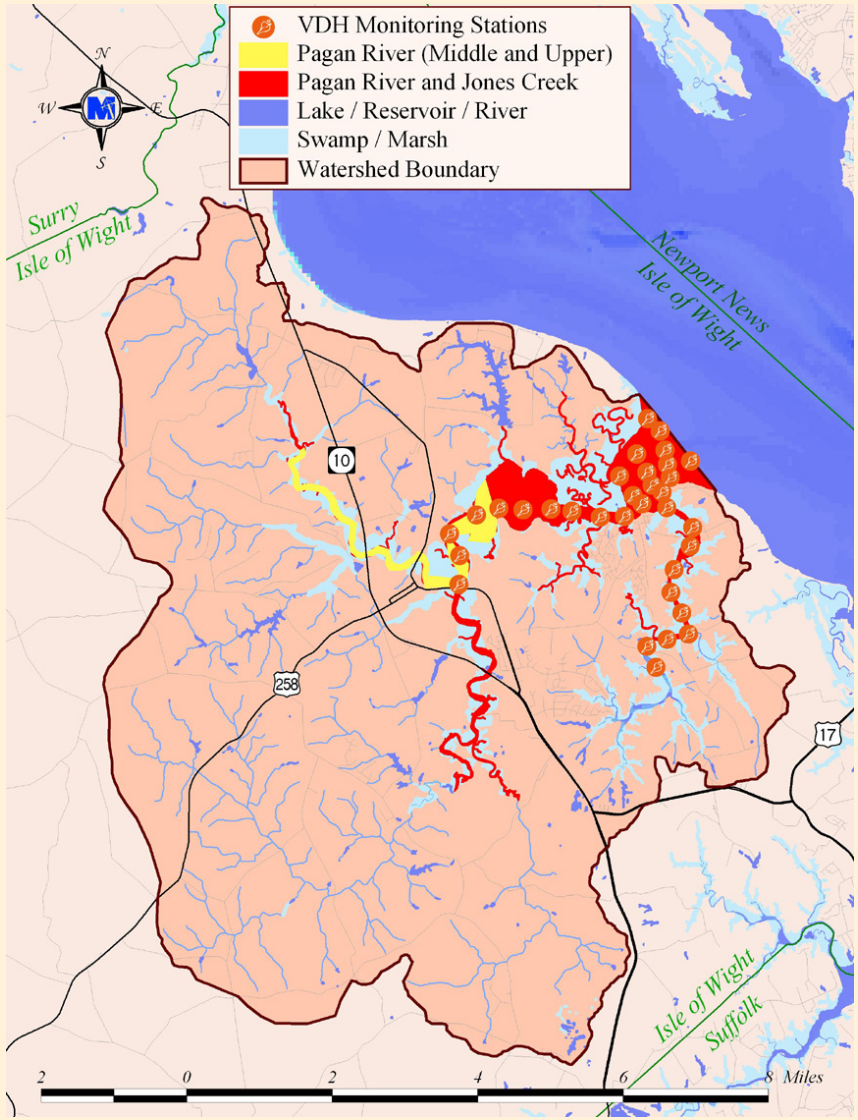
VADEQ *Enterococci* Data

March 2000 through December 2005

Stream	Station	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Median (cfu/100mL)	Standard Deviation	# above 104 MPN	Violation[1] (%)
Champion Swamp	2-CPN004.81	No data	No data	No data	No data	No data	No data	No data	No data
Jones Creek	2-JOG000.62	21	10	320	46	25	75	2	10%
Pagan River	2-PGN000.00	21	10	100	26	25	23	0	0%
Pagan River	2-PGN000.80	21	10	170	38	25	35	1	5%
Pagan River	2-PGN001.19	21	10	160	37	25	43	2	10%
Pagan River	2-PGN002.58	21	10	120	37	25	32	2	10%
Pagan River	2-PGN003.57	21	10	180	52	25	55	5	24%
Pagan River	2-PGN004.57	21	10	180	52	25	49	4	19%
Pagan River	2-PGN005.46	21	10	380	74	40	86	4	19%
Pagan River	2-PGN006.65	21	10	600	138	50	176	7	33%
Pagan River	2-PGN007.44	21	10	1,200	128	30	256	7	33%
Pagan River	2-PGN008.42	21	10	1,700	227	80	417	8	38%
Pagan River	2-PGN010.07	6	10	800	247	130	307	3	50%

[1]Violations are based on the current enterococci 90th percentile standard (104 MPN)

VDH Monitoring



VDH Fecal Coliform Data

Station	Stream	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Median (cfu/100mL)	Geomean Violation[1] %	90th Percentile[2] Violation%
61--0.5Z	Pagan River	239	2.9	1,200	31.5	9.1	0	55
61-1	Pagan River	159	2.9	240	11.9	3.6	0	0
61-1A	Pagan River	168	2.9	1,100	25	3.6	0	0
61-1B	Pagan River	158	2.9	1,200	38.3	7.3	0	24
61-1Y	Pagan River	169	2.9	1,200	54	9.1	6	86
61-1Z	Pagan River	212	2.9	240	16.5	3.6	0	6
61-2	Pagan River	175	2.9	1,200	52.9	11	71	74
61-2A	Pagan River	216	2.9	1,200	31.2	9.1	3	42
61-2B	Pagan River	174	2.9	1,200	51.8	9.1	30	65
61-2Z	Pagan River	175	2.9	1,100	66.7	15	57	71
61-3	Pagan River	175	2.9	1,200	56.3	23	76	88
61-3A	Pagan River	170	2.9	1,200	35.5	15	36	36
61-3B	Beatty Creek outlet	170	2.9	1,200	83	15	64	86
61-4	Pagan River	174	2.9	1,100	67.4	23	100	100
61-5	Pagan River	174	2.9	1,100	55.5	23	86	96
61-6	Pagan River	152	2.9	1,200	74.4	23	74	78
61-7	Pagan River	159	2.9	1,200	87.5	23	99	100
61-8	Pagan River	152	2.9	1,200	113.9	39	94	91
61-9	Pagan River	174	2.9	1,200	141.3	43	100	100
61-10	Pagan River	152	2.9	1,200	155.2	43	100	99
61-11	Pagan River	159	2.9	1,200	195.6	43	100	100
61-12	Pagan River	152	2.9	1,200	260.6	93	100	100
61-13	Pagan River	174	2.9	1,200	252.1	93	100	100

[1]Violations are based on the current fecal coliform geometric mean standard (14 MPN)

[2]Violations are based on the current fecal coliform 90th percentile standard (49 MPN)

VDH Fecal Coliform Data (cont.)

Station	Stream	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Median (cfu/100mL)	Geomean Violation[1] %	90th Percentile[2] Violation%
61-14	Jones Creek outlet	174	2.9	1,200	96.7	23	89	88
61-15	Jones Creek	174	2.9	1,200	93.1	23	100	100
61-16	Jones Creek	172	2.9	1,200	94.2	23	86	94
61-17	Jones Creek	151	2.9	1,200	115.1	43	100	93
61-18	Jones Creek	151	2.9	1,200	117.7	43	100	94
61-19	Jones Creek	150	2.9	1,200	134.2	43	100	93
61-20	Jones Creek	151	2.9	1,200	162.1	43	100	100
61-21	Jones Creek	151	2.9	1,200	155.5	43	100	100
61-22	Jones Creek	151	2.9	1,200	157.5	43	100	100
61-23	Jones Creek	150	2.9	1,200	142.7	43	100	100

[1]Violations are based on the current fecal coliform geometric mean standard (14 MPN)

[2]Violations are based on the current fecal coliform 90th percentile standard (49 MPN)

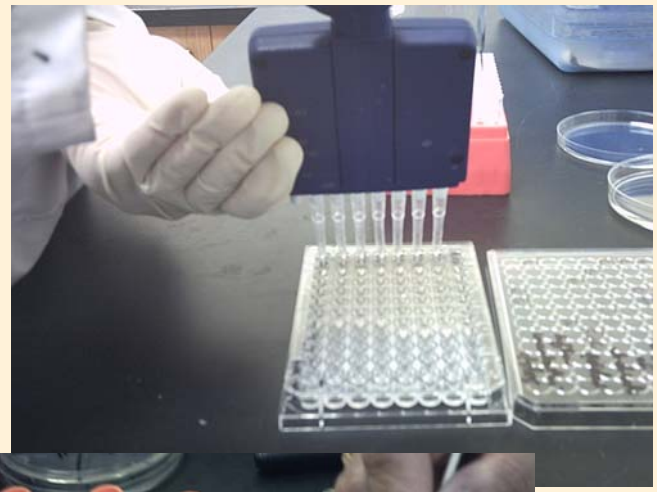
What are the Sources of Bacteria?

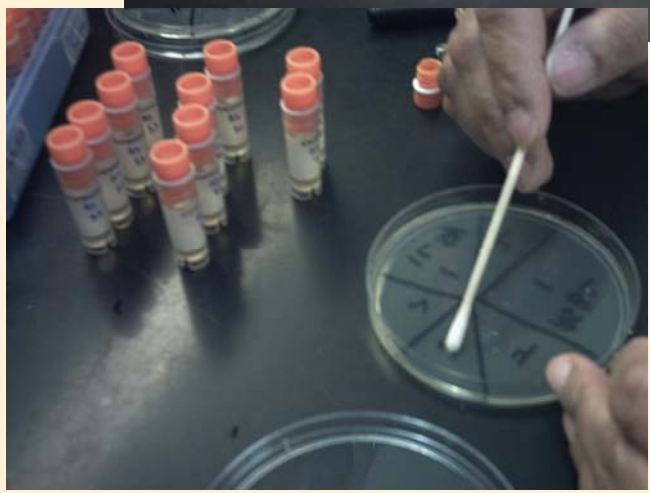
- Permitted discharges
  - Waste treatment facilities
- Human
  - Straight Pipes
  - Failing Septics
- Pets
- Livestock
- Wildlife

Bacterial Source Tracking (BST)

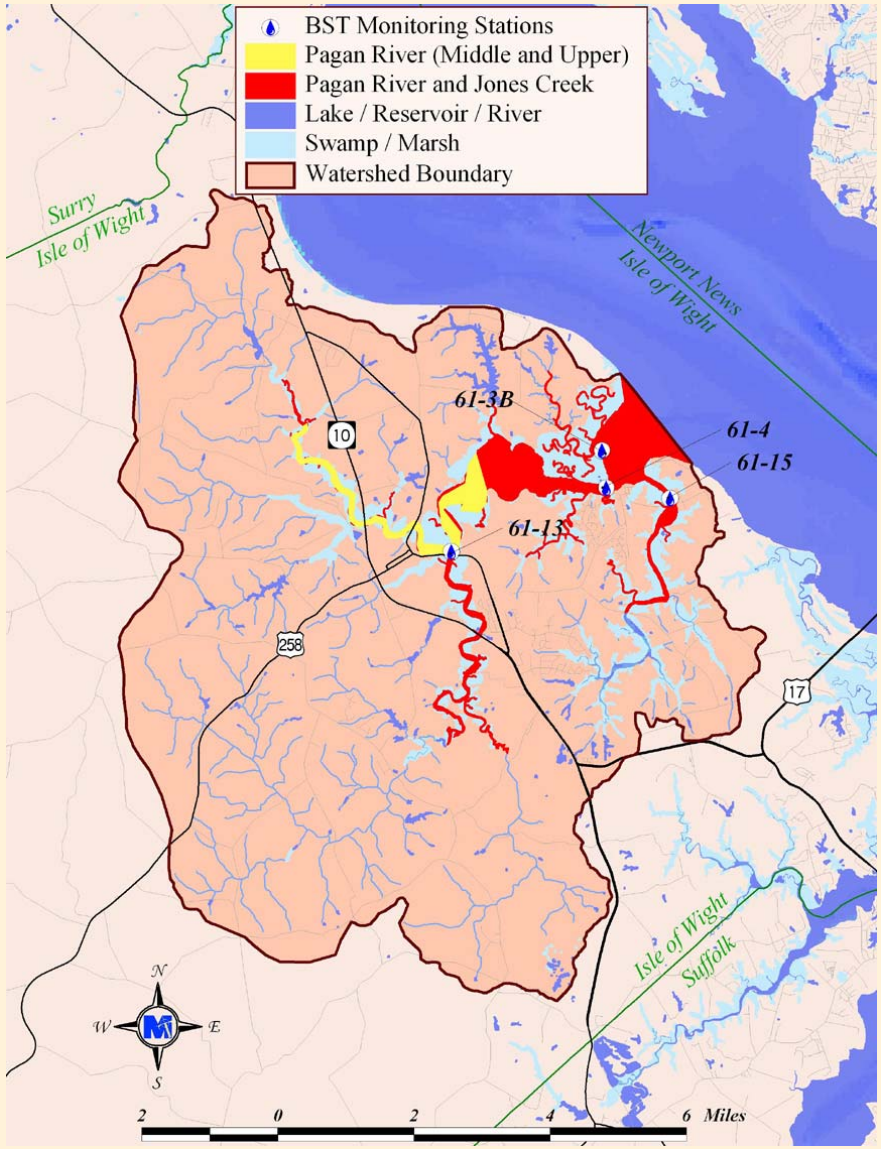
Independent Lab Test

- Determines bacteria source
  - Human
  - Pet
  - Livestock
  - Wildlife





BST Monitoring



BST Results:
What is the Predominant Source?

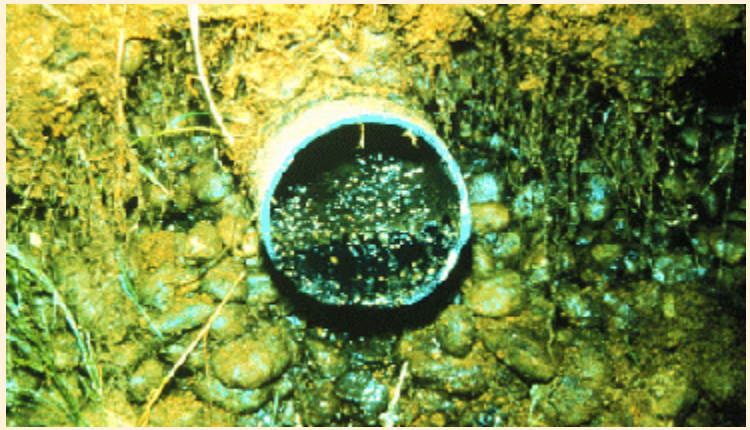
Station	Stream	Weighted Averages: Wildlife	Human	Livestock	Pet
61-13	Pagan River	35%	31%	17%	17%
61-4	Pagan River	17%	30%	19%	34%
61-15	Jones Creek	52%	13%	12%	23%
61-3B	Beatty Creek outlet	23%	13%	11%	53%

Human Sources

- **U.S. Census**
  - Population
  - Housing Units
  - On-site Sewage Treatment Systems
- **Sanitary Sewer**
  - Loading rates
    - Age, size, material of pipes
    - Overflows
  - Land-applied / direct deposition
    - Loading type
    - Proximity to stream

Human Sources

- Septic Systems
  - Failure to soil surface throughout year
  - Lateral movement continuously to stream
- Straight Pipes
  - Direct continuous input into stream
- Biosolids
  - Not applied in this watershed?



Human Population Estimates

	Housing Units				
Population	Number	With Sewer	With Septic	With Failing Septic	With Other (Straight Pipe)
15,900	6,368	2,502	3,812	623	54

Pet Sources

- Population/household based on literature values
- Translated to HU based on U.S. Census
- Land-applied

Dogs	Cats
3,400	3,808

Livestock Sources

- Population
  - Virginia Ag. Statistics
  - Consultation with Peanut SWCD, VADCR, NRCS
- Distribution of waste
  - Pastured
  - Confined and waste collected
  - Direct deposition to the stream
- Seasonal varying applications

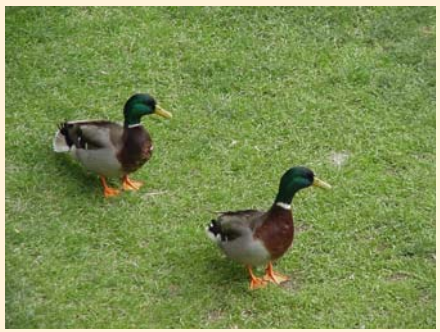
Livestock Population

Beef	Beef Calf	All Dairy	Horse	Sheep	Chickens	Hogs
411	318	0	290	4	0	16,661

Wildlife Sources

- Population based on data provided by VDGIF biologists
- Distribution of waste based on habitat
  - Land-applied
  - Direct deposition to the stream
- Seasonal variations based on migration patterns and food sources

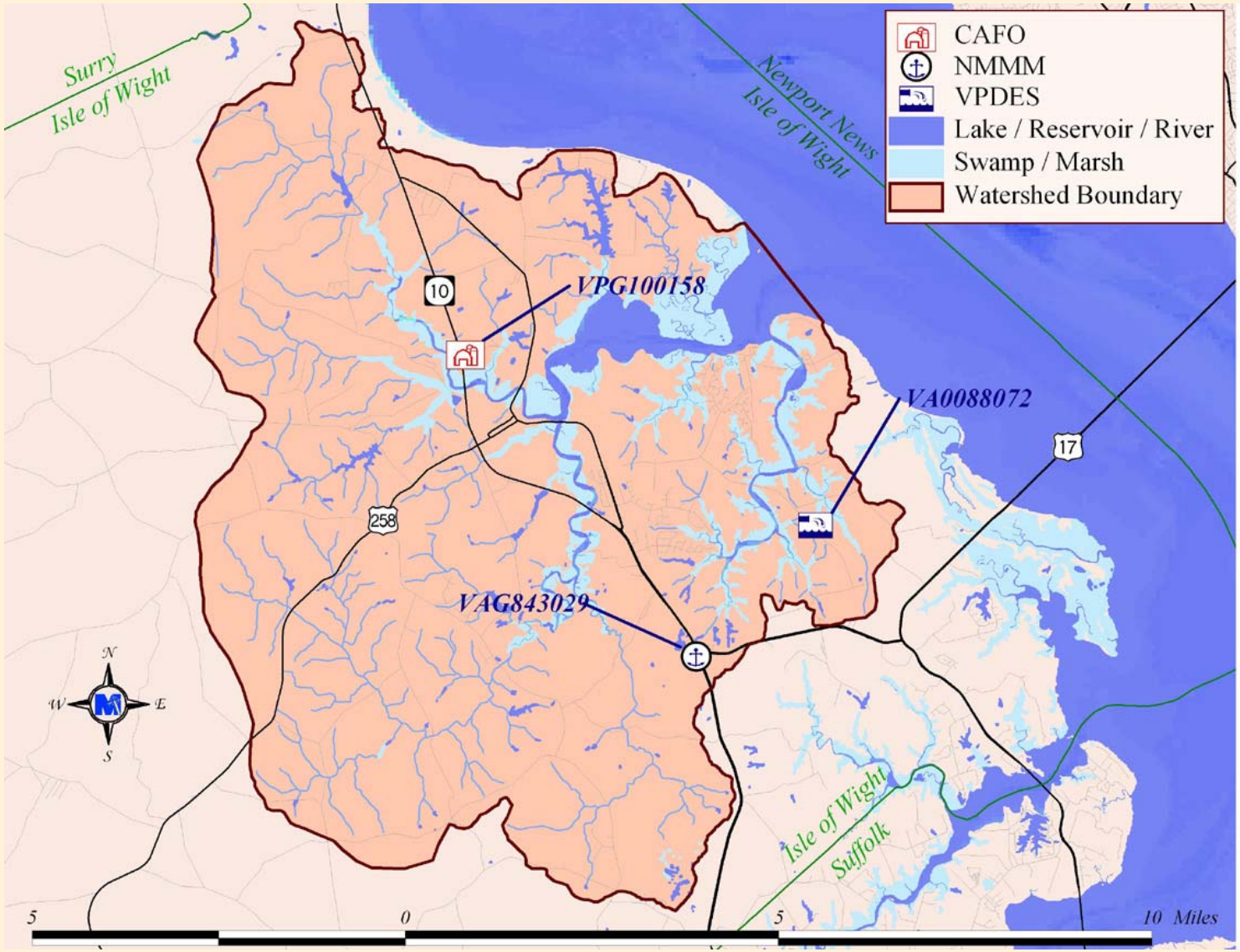
Beaver	Deer	Duck	Goose	Muskrat	Raccoon	Turkey
1,424	1,207	438	172	19,746	1,077	346



Permitted Discharges

Permit No.	Name	Type	Receiving Stream	Currently FC in discharge	Design Flow (MGD)
VA0088072	Carrollton Court	VPDES	UT to Titus Creek to Jones Creek	YES	0.0037
VAG843029	Isle of Wight Materials Co Inc - Benns Church Prop	NMMM	Jones Creek	No	0.0432
VPG100158	Berry Hill Farm Incorporated	CAFO	Pagan River	No	NA

Permitted Discharges



How do we determine the TMDLs?

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Watershed data

TMDL

Enterococci (DEQ) Total Maximum Daily Loads

Impairment	WLA (cfu/year)	LA (cfu/year)	MOS	TMDL (cfu/year)
Pagan River (Middle and Upper) *VA0088072*			*Implicit*	

Fecal Coliform (VDH)
Total Maximum Daily Loads

Impairment	WLA (cfu/year)	LA (cfu/year)	MOS	TMDL (cfu/year)
Pagan River and Jones Creek *VA0088072*			*Implicit*	

What bacteria reductions are required?

What's next?

- Final Public Meeting (TBD)
- Public Review
- Submit to EPA
- State Approval
- Implementation Plan Development
- Implementation

Pagan River TMDL Contacts

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Questions?